TRAFFIC SPEED REPORT NO. 84

TRUCK WEIGHT-SPEED STUDY

MAY, 1967

NO. 10

by

ROBERT MAXMAN

Progress Report

TRAFFIC SPEED REPORT NO. 84
TRUCK WEIGHT-SPEED STUDY

TO: G. A. Leonards, Director
Joint Highway Research Project

May 11, 1967

File: 8-3-4

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-10D

Attached is a Progress Report entitled "Traffic Speed Report No. 84: Truck Weight-Speed Study." This is another in our continuing series of reports on our annual measurement of truck speeds in cooperation with the Indiana State Highway Commission. The Commission obtains truck weights and this study analyzes any correlation which exists between truck weight and truck speed.

The study and attached report were performed by Mr. Robert Maxman, Research Assistant on our staff in August and September 1966. Little correlation was found again this year between weight and speed of trucks. In addition the large number of trucks, especially of heavy weight, which exceeded the speed limit is reported and the trend in truck speeds is noted. The recent change in Indiana speed limits for trucks so as to provide for no differential between cars and trucks of any weight is shown to be reality.

The report is normally distributed to the Bureau of Public Roads, the Indiana State Police, the Indiana Office of Traffic Safety and the Indiana Traffic Safety Council, Inc. Approval of such distribution in addition to the normal distribution is requested. The report is presented for the record and for information.

Respectfully submitted,

Harold L. Michael
Associate Director

HLM:ss

Attachment

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Progress Report

TRAFFIC SPEED REPORT NO. 84
TRUCK WEIGHT-SPEED STUDY

by

Robert Mannan
Research Assistant

Joint Highway Research Project

File No: 8-3-4

Project No: C-36-10D

Purdue University

Lafayette, Indiana

May 11, 1967

Acknowledgements

I wish to thank Mr. Edward Fleischman for supervising the computational aspects of the data analysis. Also, my thanks to Mr. Gordon Shunk for handling the computer programming needed for the multiple regression analysis and computation of 95% confidence limits. The cooperation of Indiana State Highway Commission personnel at the truck weight stations and in providing the truck weight data are also sincerely appreciated and acknowledged.

Traffic Speed Report 84
Truck Weight-Speed Study

Abstract

This report is of the annual continuing study of the relationship between truck weights and truck speeds on Indiana highways. The weight and speed data contained in this report were taken during August and September 1966.

Analysis of the data indicated a slight increase in truck speeds and a small decrease in truck weights. The correlation between the weight and speed was found to be low, indicating that other factors are more influential on truck speeds.

Traffic Speed Report No. 84

This report is an analysis of data taken in August and September of 1966 by personnel of the Joint Highway Research Project in cooperation with members of the Indiana State Highway Commission. This is another in the series of continuing studies on truck speed, truck weight and the correlation between truck speed and weight which has been conducted by the Joint Highway Research Project since 1949.

Each year during the months of August and September the Indiana State Highway Commission conducts a study of truck weights on Indiana highways. In this study, the type of truck, axle spacing, axle loadings, and material hauled are recorded at 23 stations throughout the state.

This report analyzes the gross weight figures, obtained by the Indiana State Highway Commission, in relation to free flowing speeds of the same trucks, obtained by personnel of the Project. The weights were obtained through the use of loadometers and pit scales; the speeds were recorded at a radar meter placed approximately two miles from the weight stations. Each truck used in the analysis was positively identified at both data collection points in order to assure that the speed and weight could be assigned to the same truck.

Eleven stations were used for the Speed-Weight analysis. The eleven stations are shown in Figure 1 and further described as follows:

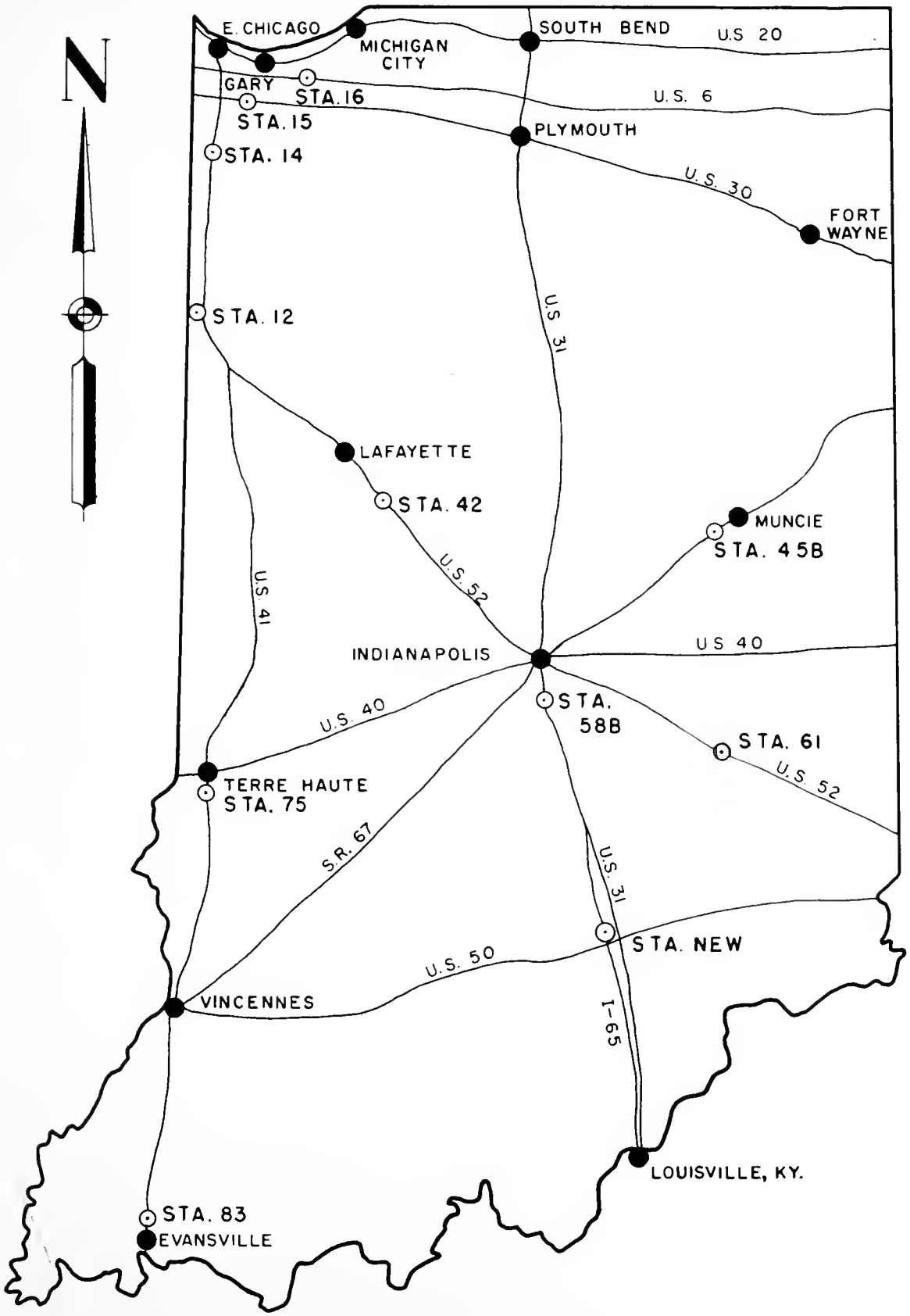

FIG. 1 LOCATIONS OF TRUCK WEIGHT-SPEED STATIONS

STATION	HIGHWAY	LOCATION	Date of Observation	No. of Lanes
58B	U. S. 31	2000' S. of Southport Road	Aug. 23	4
75	U. S. 41	.25 mi. S. of U. S. 41 Business	Aug. 24	4
83	U. S. 41	. 5 mi. N. of S. R. 37	Aug. 26	4
New	I-65	.25 mi. N. of U. S. 50	Aug. 29	4
61	U. S. 52	1.3 mi. S.E. of Jct. U. S. 52 & S. R. 3	Aug. 30	2
45B	S. R. 67	1.0 mi. S.W. of Muncie	Sept. 1	2
16	U. S. 6	3.0 mi. W. of S. R. 49	Sept. 12	2
15	U. S. 30	Between S. R. 55 & S. R. 53	Sept. 13	4
14	U. S. 41	. 5 mi. S. of N. Jct. of S. R. 2	Sept. 14	4
12	U. S. 52	2.25 mi. W. of U. S. 41	Sept. 15	2
42	U. S. 52	600' E. of N. Jct. of S. R. 28	Sept. 29	4

Equipment and Field Procedure

The speed data were taken on level tangent sections of highway approximately 2-4 miles from the weight stations. Since the speed of "free flowing" trucks was desired, each location for the speed check was chosen so that no railroad or intersection influences existed. As each truck approached the speed check it was noted whether or not there were any other vehicles influencing its speed (such as a slow moving vehicle ahead). Any truck that could not be considered "free flowing," i. e. no influences on speed other than those of the vehicle and its driver, was not considered in the sample.

The speeds were obtained by the use of an electronic radar meter. The meters used were manufactured by Automatic Signal Division, Eastman Industries, Inc., East Norwalk, Connecticut. Each of the two meters used was tested using a "fifth wheel" prior to the study. Each meter was found to have an error of less than one mile per hour, making calibration curves unnecessary. The calibrated speedometer on the car used to transport the equipment throughout the study and 30, 45 and 60 mph tuning forks were used to assure the continued accuracy of radar meter readings.

The speed meter was placed approximately four feet from the edge of the pavement and aimed so as to make an angle of less than 10 degrees with the center line of the road. The meter was placed in a green card board container that was similar in shape and size to those used as trash barrels along Indiana highways. Futhermore, no vehicle was parked in the vicinity of the radar meter at any time. These precautions along with a 50 ft. chord which enabled all personnel to observe from a position well off of the roadside, enabled the speed readings to reflect, as much as possible, true speeds.

Truck speed and weight data were collected from 8 A.M. to 4 P.M. The speed and weight of trucks travelling in one direction was taken during the four A.M. hours; in the afternoons the data was taken of trucks travelling in the other direction. At the weight stations the recorder noted the weight of each truck, the time it left the station, the color of the cab, color of the trailer, any large name or number, number of axles and other important identifying data. At the speed station the recorder noted speed, time, no. of axles, color or any other important identifying characteristics. With an estimate of the approximate time interval between stations and the other identifying characteristics recorded the truck weights were matched with the appropriate truck speeds without difficulty.

Analysis

For the purpose of analysis the trucks were classified as single unit under 5,000 lbs., single unit above 5,000 lbs., or multi-unit. An analysis was made for each type of roadway: two-lane, four-lane and interstate. The Indiana speed limits for these weight classifications on the three types of roads are as follows:

70 MPH	for light trucks (less than 5,000 lb.) on interstate highways
65 MPH	for light trucks on other roadways
55 MPH	for heavy trucks (5,000 lbs. or more) on 4-lane highways with a median of 20 feet or more and on interstate highways
50 MPH	for heavy trucks on other roadways

Station	15		14		Total Four-Lane		Interstate New		Total Two-Lane, Four-Lane Interstate	
Weight (kips)	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	
0-4	1	---	---	54.3	9	---	---	54.4	16	
4-5	8	---	---	54.0	44	63.4	4	52.5	97	
Light Trucks	9	0		53		4		113		
Ave. wt.(lbs)	370	----		4,270		4,380		4,320		
Ave. Speed	5.3	----		54.0		63.4		52.8		
Conf. Level	95	----		95		95		95		
Upper C.Limit	0.4	----		56.1		68.7		54.3		
Lower C.Limit	2.2	----		52.9		58.1		51.3		
5-8	4	68.3	3	53.8	48	60.0	8	53.9	125	
8-12	6	58.0	3	52.7	60	57.6	11	52.9	100	
12-16	6			51.1	34	56.6	10	51.3	62	
16-20	1	58.3	4	52.6	31	59.6	13	52.3	62	
20-24	4	52.5	2	51.3	21	59.5	2	50.5	37	
24-28	1	53.0	1	50.3	9	58.0	1	51.8	15	
28-32	1			52.7	6			52.6	7	
32-36	1			52.5	4			50.6	5	
36-40	1			44.3	6			45.3	10	
40-44				42.0	2			39.3	3	
44-48								48.0	1	
48-52										
52-56										
56-60										
Heavy Trucks	25	13		221		45		427		
Ave. wt.(lbs)	300	13,520		14,640		13,320		13,670		
Ave. Speed	1.0	59.2		52.1		58.5		52.3		
Conf. Level	95	95		95		95		95		
Upper C.Limit	2.9	63.4		53.0		59.9		54.2		
Lower C.Limit	9.1	55.0		51.2		57.1		50.4		

TABLE 1. SINGLE UNIT TRUCK SPEEDS (MPH)

Station	Two-Lane Highways										Four-Lane Highways														Interstate		Total Two-Lane, Four-Lane Interstate	
	45		61		16		12		Total Two-Lane		83		42		58		75		15		14		Total Four-Lane		New			
Weight (kips)	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks
0-4	55.0	2	50.0	1	56.7	3	51.0	1	54.4	7	50.0	4	50.0	1	56.3	3	---	---	60.0	1	---	---	54.3	9	---	---	54.4	16
4-5	49.2	14	49.5	19	53.0	2	52.2	14	50.3	49	54.4	11	60.0	2	54.7	10	51.0	13	55.8	8	---	---	54.0	44	63.4	4	52.5	97
Light Trucks	16		20		5		15		56		15		3		13		13		9		0		53		4		113	
Ave. wt.(lbs)	4,290		4,480		3,740		4,490		4,360		4,290		4,070		4,140		4,340		4,370		----		4,270		4,380		4,320	
Ave. Speed	49.9		49.5		55.2		52.1		50.8		53.2		60.0		55.1		51.0		56.3		----		54.0		63.4		52.8	
Conf. Level	95		95		95		95		95		95		95		95		95		95		----		95		95		95	
Upper C.Limit	54.6		53.3		60.5		54.4		52.7		57.8		64.5		58.7		56.6		60.4		----		56.1		68.7		54.3	
Lower C.Limit	45.2		45.7		49.9		49.8		48.9		48.6		55.5		51.5		45.4		52.2		----		52.9		58.1		51.3	
5-8	52.3	21	52.5	31	54.0	7	56.4	10	53.2	69	52.8	10	60.0	5	49.1	13	54.2	13	51.3	4	68.3	3	53.8	48	60.0	8	53.9	125
8-12	52.2	13	52.0	4	53.5	4	49.0	8	51.5	29	50.6	15	56.0	9	52.8	9	51.7	18	52.8	6	58.0	3	52.7	60	57.6	11	52.9	100
12-16	50.2	5	49.2	5	43.3	3	50.0	5	48.7	18	53.8	10	53.5	4	51.2	5	49.8	9	47.0	6			51.1	34	56.6	10	51.3	62
16-20	46.6	7	44.6	5	49.0	4	45.0	2	46.4	18	54.5	11	54.0	1	52.5	4	48.1	10	54.0	1	58.3	4	52.6	31	59.6	13	52.3	62
20-24	50.0	3	46.8	6	53.5	2	45.0	3	48.1	14	48.8	8	50.0	1			51.8	6	55.0	4	52.5	2	51.3	21	59.5	2	50.5	37
24-28	58.0	3	48.0	1	44.0	1			53.2	5	49.8	5			45.0	1	50.0	1	56.0	1	53.0	1	50.3	9	58.0	1	51.8	15
28-32					52.0	1			52.0	1	57.5	2			52.0	1	50.0	2	49.0	1			52.7	6			52.6	7
32-36							43.0	1	43.0	1	50.0	1			52.0	1	65.0	1	43.0	1			52.5	4			50.6	5
36-40			48.0	1			46.3	3	46.7	4	45.0	1			44.0	3	40.0	1	49.0	1			44.3	6			45.3	10
40-44					34.0	1			34.0	1							42.0	2					42.0	2			39.3	3
44-48	48.0	1							48.0	1																	48.0	1
48-52																												
52-56																												
56-60																												
Heavy Trucks	53		53		23		32		161		63		20		37		63		25		13		221		45		427	
Ave. wt.(lbs)	12,000		10,660		14,990		14,270		12,440		15,500		10,260		13,870		14,800		17,300		13,520		14,640		13,320		13,670	
Ave. Speed	51.4		50.6		50.2		50.4		50.8		52.0		56.1		50.4		51.0		51.0		59.2		52.1		58.5		52.3	
Conf. Level	95		95		95		95		95		95		95		95		95		95		95		95		95		95	
Upper C.Limit	53.4		52.6		53.2		52.5		51.4		53.4		58.8		52.7		52.7		52.9		63.4		53.0		59.9		54.2	
Lower C.Limit	49.4		48.6		47.2		48.3		50.2		50.6		53.4		48.1		49.3		49.1		55.0		51.2		57.1		50.4	

Station	15		14		Total Four-Lane		Interstate		Total Two-Lane, Four-Lane Interstate	
Weight (kd	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	
8-12				52.0	1			51.5	2	
12-16						56.0	2	57.3	3	
16-20	7	53.0	1	52.9	21	55.6	7	53.1	33	
20-24	10	58.0	4	53.6	47	57.4	30	54.1	93	
24-28	22	54.8	17	55.2	77	59.6	51	56.5	153	
28-32	9	57.4	12	55.2	61	58.1	15	54.3	103	
32-36	11	57.4	7	53.1	38	60.9	14	54.6	65	
36-40	8	58.3	9	54.6	45	59.1	7	54.5	65	
40-44	7	55.5	8	52.1	29	58.1	9	52.9	45	
44-48	9	58.1	3	50.6	27	56.7	10	51.4	48	
48-52	5	56.2	6	51.9	25	53.3	6	51.8	39	
52-56	8	55.7	6	52.9	27	58.6	8	53.1	50	
56-60	8	57.3	6	52.1	48	57.9	9	53.1	60	
60-64	8	56.0	3	52.1	33	57.8	5	51.8	44	
64-68	11	59.1	4	53.1	37	58.0	7	52.6	62	
68-72	10	56.8	12	54.1	56	57.1	13	53.2	88	
72-76	7	58.6	5	52.0	39	57.4	20	53.3	66	
76-80		56.8	4	51.3	26			51.0	36	
80-84				51.7	9			51.7	9	
84-88				55.0	1			53.5	2	
88-92										
92-96				46.0	1			46.0	1	
96-100										
Total Tr	140		107		649		213		1068	
Ave. wt.	900		48,880		47,330		40,130		45,510	
Ave. Spe	4.1		56.7		53.4		58.1		53.7	
Conf. Le	95		95		95		95		95	
Upper C.	4.8		57.4		53.8		58.7		54.1	
Lower C.	3.4		56.0		53.0		57.5		53.3	

TABLE 2. MULTI-UNIT TRUCK SPEEDS (MPH)

Station	Two-Lane Highways										Four-Lane Highways														Interstate		Total Two-Lane, Four-Lane Interstate	
	45		61		16		12		Total Two-Lane		83		42		58		75		15		14		Total Four-Lane					
Weight (kips)	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks
8-12							51.0	1	51.0	1					52.0	1							52.0	1			51.5	2
12-16							60.0	1	60.0	1															56.0	2	57.3	3
16-20					50.5	4	52.0	1	50.8	5	53.6	8	50.0	1	53.0	3	51.0	1	52.6	7	53.0	1	52.9	21	55.6	7	53.1	33
20-24	51.3	3	59.0	1	47.2	9	50.3	3	49.3	16	54.8	10	50.3	6	50.9	11	55.2	6	54.5	10	58.0	4	53.6	47	57.4	30	54.1	93
24-28	54.6	5	54.7	3	54.4	10	52.3	7	53.9	25	55.2	12	54.3	8	51.7	6	52.0	12	58.5	22	54.8	17	55.2	77	59.6	51	56.5	153
28-32	50.4	11	53.5	2	49.3	6	50.0	8	50.3	27	56.9	13	52.5	11	53.6	8	55.3	8	54.5	9	57.4	12	55.2	61	58.1	15	54.3	103
32-36	47.0	4			50.4	5	60.3	4	52.4	13	50.0	4	51.8	6	50.8	4	51.5	6	53.8	11	57.4	7	53.1	38	60.9	14	54.6	65
36-40	48.0	2	54.0	1	49.3	4	54.0	6	51.6	13	51.3	4	52.8	13	53.4	5	55.5	6	55.3	8	58.3	9	54.6	45	59.1	7	54.5	65
40-44	53.0	2			50.0	4	42.0	1	49.7	7	49.7	6	54.0	1	51.4	5	48.5	2	51.6	7	55.5	8	52.1	29	58.1	9	52.9	45
44-48	47.8	4			48.0	4	50.0	3	48.5	11	53.0	4	54.0	2	52.7	7	50.5	2	57.7	9	58.1	3	50.6	27	56.7	10	51.4	48
48-52					50.4	8			50.4	8	54.0	1	49.3	8	48.5	4	50.0	1	53.6	5	56.2	6	51.9	25	53.3	6	51.8	39
52-56	46.7	3	56.3	3	50.5	8	43.0	1	50.4	15	54.8	4	50.7	3	50.0	4	52.0	2	52.5	8	55.7	6	52.9	27	58.6	8	53.1	50
56-60					54.0	3			54.0	3	53.1	8	49.6	11	51.6	8	51.3	7	51.9	8	57.3	6	52.1	48	57.9	9	53.1	60
60-64					43.8	5	49.0	1	44.7	6	57.7	7	45.1	7	50.5	4	52.5	4	52.6	8	56.0	3	52.1	33	57.8	5	51.8	44
64-68	52.7	3			48.1	11	51.5	4	49.6	18	53.3	10	51.3	3	49.6	7	54.0	2	53.2	11	59.1	4	53.1	37	58.0	7	52.6	62
68-72	53.0	3	50.0	1	46.3	10	48.4	5	48.1	19	56.7	14	49.6	7	50.6	5	54.1	8	52.5	10	56.8	12	54.1	56	57.1	13	53.2	88
72-76			59.0	2	43.3	3	46.5	2	48.7	7	54.4	10	57.5	4	51.8	9	50.0	4	47.5	7	58.6	5	52.0	39	57.4	20	53.3	66
76-80	48.5	4	55.0	1			50.8	5	50.3	10	45.0	1	56.0	2	49.2	10	50.7	9			56.8	4	51.3	26			51.0	36
80-84											66.0	1	52.0	2	50.0	3	48.3	3					51.7	9			51.7	9
84-88	52.0	1							52.0	1							55.0	1					55.0	1			53.5	2
88-92																												
92-96															46.0	1							46.0	1			46.0	1
96-100																												
Total Trucks	45		14		94		53		206		117		96		105		84		140		107		649		213		1068	
Ave. wt.(lbs)	44,860		47,270		46,120		43,940		45,360		47,010		46,240		50,230		49,100		43,900		48,880		47,330		40,130		45,510	
Ave. Speed	50.3		55.4		49.1		51.4		50.4		54.5		50.3		51.1		52.5		54.1		56.7		53.4		58.1		53.7	
Conf. Level	95		95		95		95		95		95		95		95		95		95		95		95		95		95	
Upper C.Limit	51.6		57.9		50.4		52.7		51.2		55.3		51.6		51.9		53.8		54.8		57.4		53.8		58.7		54.1	
Lower C.Limit	49.0		52.9		47.8		50.1		49.6		53.7		49.0		50.3		51.2		53.4		56.0		53.0		57.5		53.3	

Table 3 gives the percent of trucks exceeding the speed limit and 5 miles above the speed limit for each station. A summary of these results is as follows:

	Single Unit		
	light	heavy	Multi-Unit
2-lane			
Above Speed Limit	3.6	44.7	45.1
5 MPH Above Limit	0.0	23.0	18.9
4-lane			
Above Speed Limit	9.4	28.5	32.5
5 MPH Above Limit	0.0	6.8	6.8
Interstate			
Above Speed Limit	0.0	68.9	69.1
5 MPH Above Limit	0.0	17.8	19.6

Table 4 lists the number of observations, average speed, and average weight for each truck classification for the past eighteen years.

Figures 2, 3, 4, and 5 show graphically the accumulative speed distribution for each classification of truck on two-lane, four-lane, and interstate highways and on all of these road types. Figures 6 and 7 show the trends in the 85th percentile truck speed for two-lane and four-lane roadways for the past thirteen years. This is the first year an interstate highway was included in the study.

Figures 8 and 9 show the relationship, as developed by the linear regression analysis, between truck weight and speed for single unit and multi-unit truck on each type of roadway.

TABLE 3

PERCENTAGE OF TRUCKS EXCEEDING SPEED LIMITS

		Single Unit Trucks					Multiple Unit Trucks		
		Trucks Weighing Under 5,000 lbs			Trucks Weighing Over 5,000 lbs		All Weights		
	Sta.	No. Trucks Observed	% Exceeding 65 MPH	% Exceeding 70 MPH	No. Trucks Observed	% Exceeding 50 MPH	% Exceeding 55 MPH	No. Trucks Observed	% Exceeding 50 MPH	% Exceeding 55 MPH
Two Lane	45B	16	6.3	0.0	53	52.8	32.6	45	48.9	15.6
	61	20	5.0	0.0	53	41.5	24.5	14	21.5	28.6
	16	5	0.0	0.0	23	56.5	30.4	94	43.6	17.0
	12	15	0.0	0.0	32	46.9	15.6	53	47.1	22.6
	All Two Lane	56	3.6	0.0	161	44.7	23.0	206	45.1	18.9
						% Exceeding 55 MPH	% Exceeding 60 MPH		% Exceeding 55 MPH	% Exceeding 60 MPH
Four Lane	83	15	13.3	0.0	63	19.1	1.6	117	41.0	6.0
	42	3	66.7	0.0	20	50.0	20.0	96	26.1	2.1
	58	13	0.0	0.0	37	24.3	2.7	105	13.3	1.9
	75	13	0.0	0.0	63	27.0	9.5	84	23.8	7.1
	15	9	11.1	0.0	25	20.0	0.0	140	25.0	5.7
	14	0	0.0	00.0	13	76.9	23.1	107	64.5	17.8
	All Four Lane	53	9.4	0.0	221	28.5	6.8	649	32.5	6.8
			% Exceeding 70 MPH	% Exceeding 75 MPH						
	Interstate 99	4	0.0	0.0	45	68.9	17.8	214	69.1	19.6

TABLE 4

TRUCK-WEIGHT SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

	Single-Unit			Multi-Unit		
Year	Number	Average Speed	Average Weight	Number	Average Speed	Average Weight
1949	578	42.2	9,400	581	43.2	32,500
1950	791	42.4	8,700	879	42.7	36,700
1951	1,242	43.0	8,600	1,402	43.5	36,700
1952	1,482	43.4	8,700	1,354	44.1	35,900
1953	1,239	43.9	8,400	1,507	43.1	35,800
1954	905	45.8	8,000	1,064	43.6	37,400
1955	762	45.9	8,900	1,120	43.5	38,400
1956	952	47.0	8,300	1,033	44.4	37,900
1957	1,028	46.3	9,400	1,161	42.5	37,100
1958	837	46.5	9,900	1,130	46.1	39,500
1959	481	45.5	9,200	604	48.6	40,300
1960	424	49.1	12,000	644	50.3	39,300
1961	938	48.0	10,600	1,149	48.6	42,600
1962	610	48.7	11,800	1,079	49.2	42,700
1963	488	44.9	11,500	736	45.9	43,600
1964	677	50.6	11,200	1,176	51.1	44,100
1965	543	49.2	12,900	1,165	50.7	46,100
1966	540	~~51.9~~ 52.4	11,700	1,068	53.7	45,500

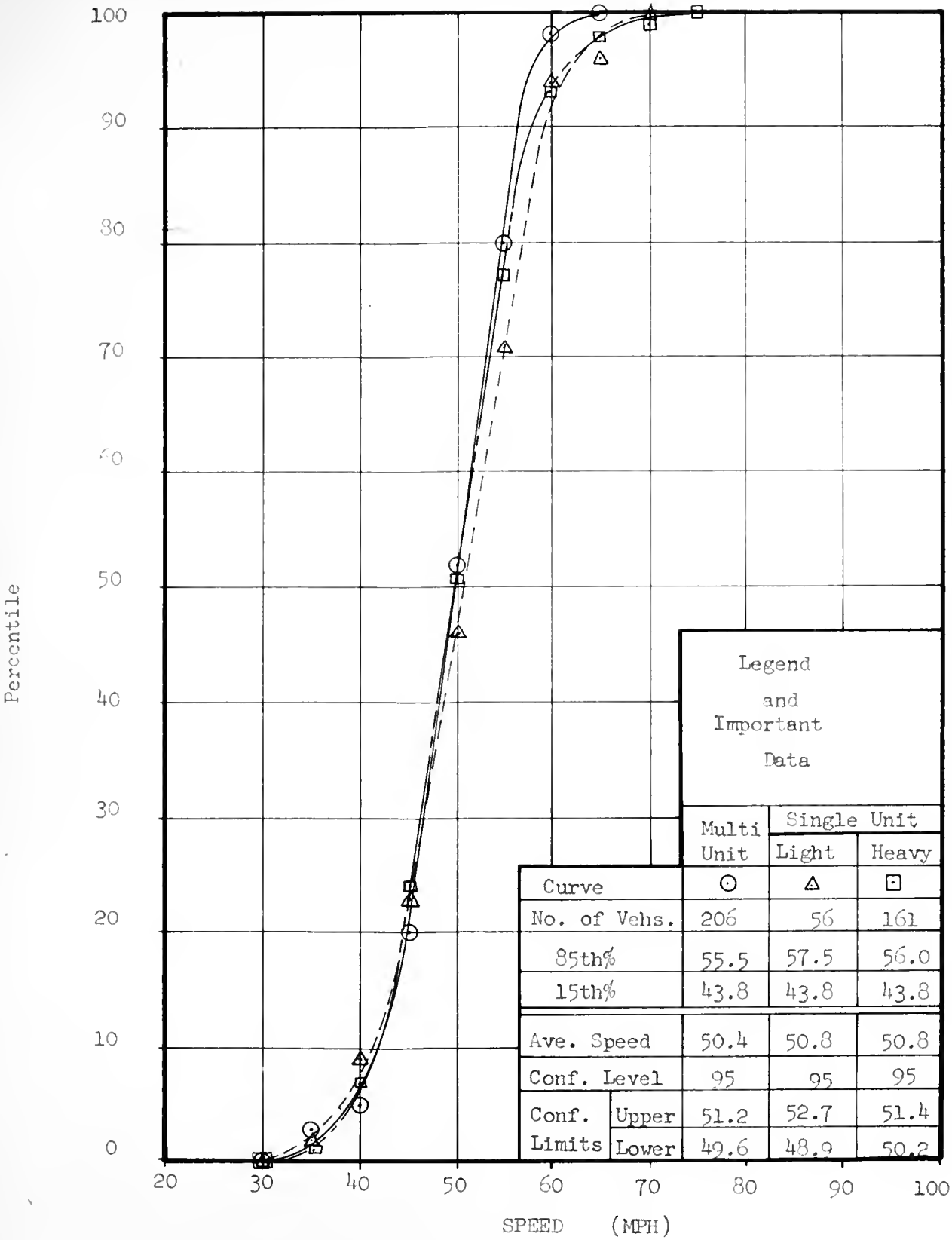

Figure 2, Accumulative Speed Curves,

Two-Lane Highways

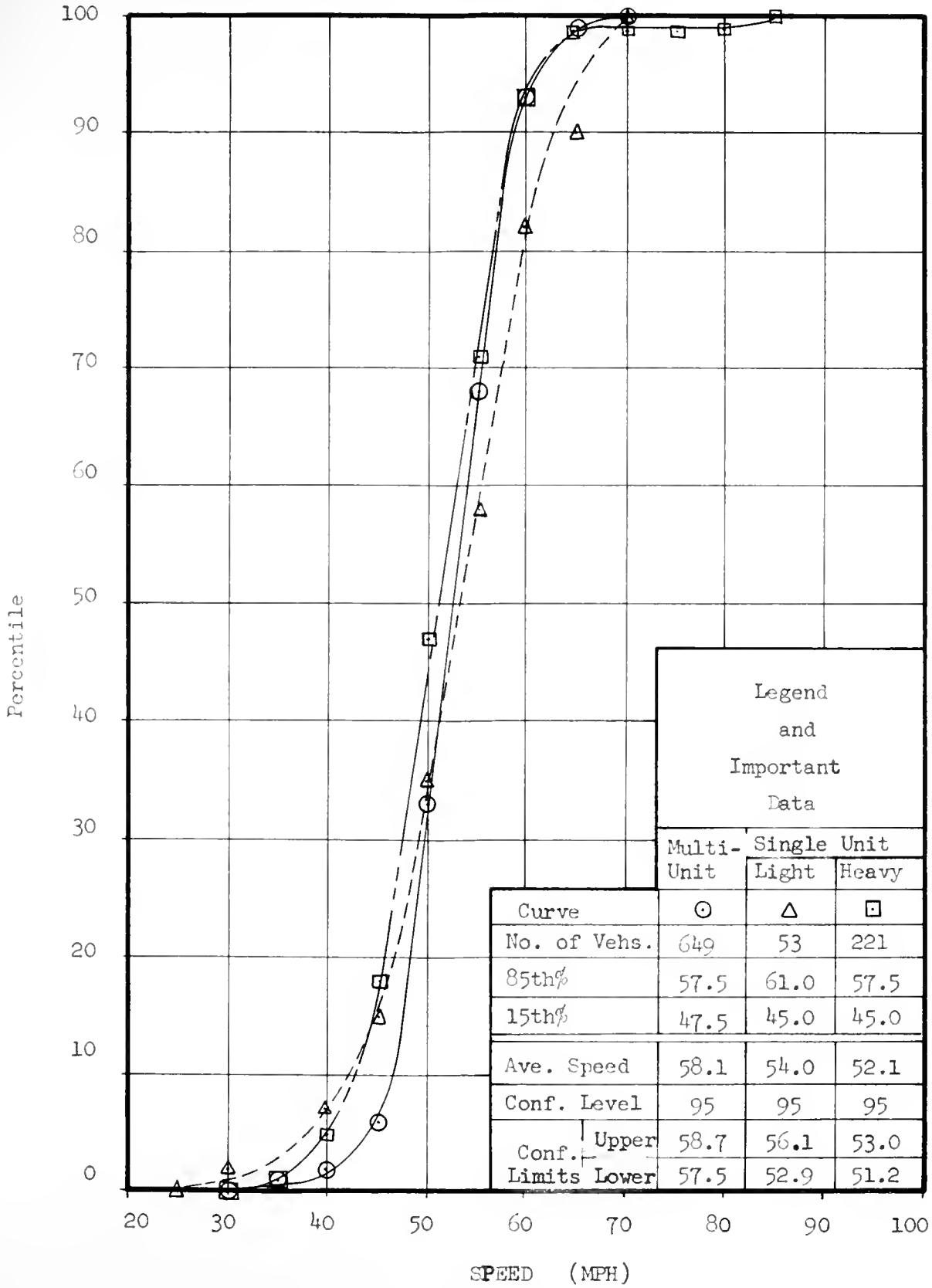

Figure 3, Accumulative Speed Curves,

Four-Lane Highways

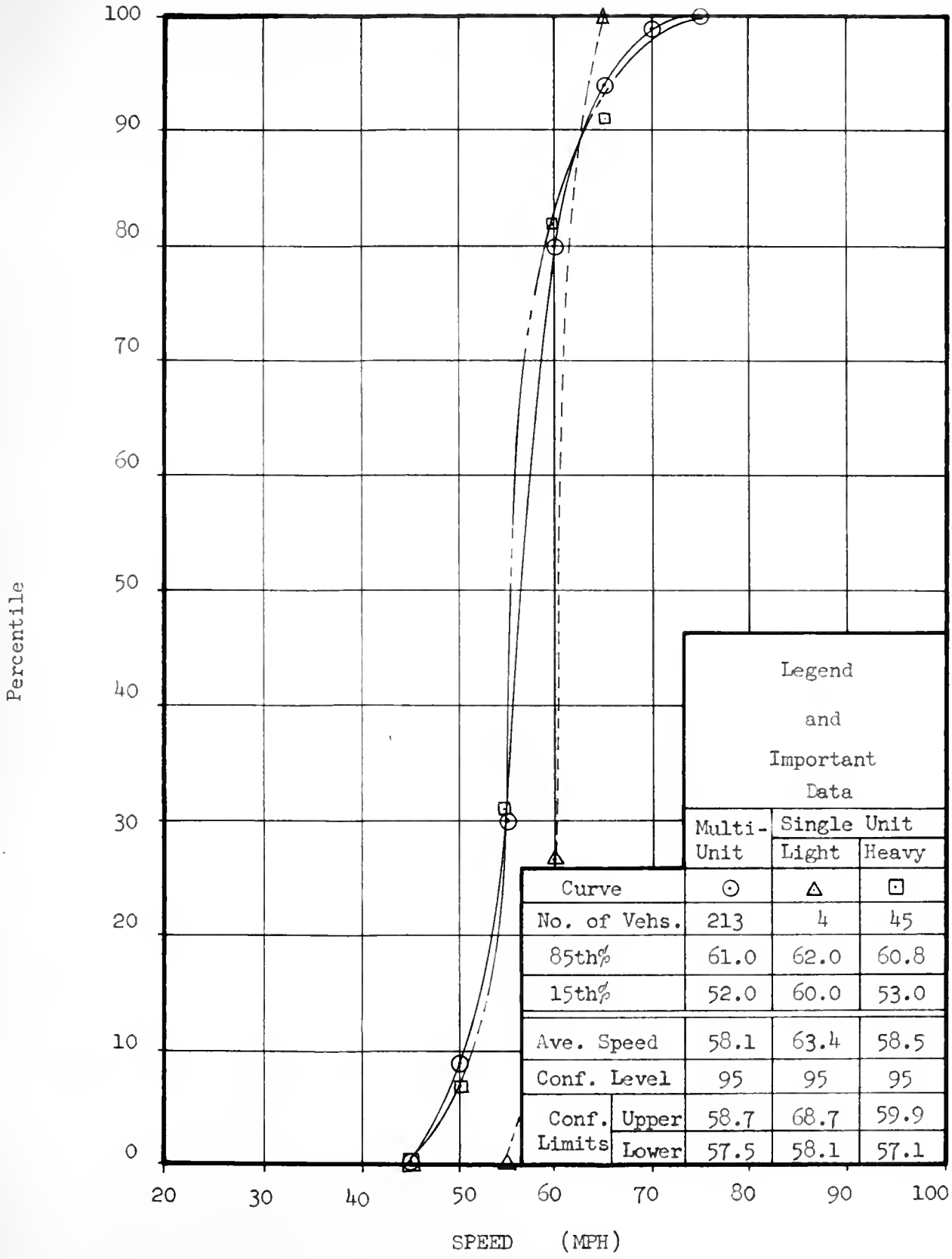

Figure 4, Accumulative Speed Curves,

Interstate Highways

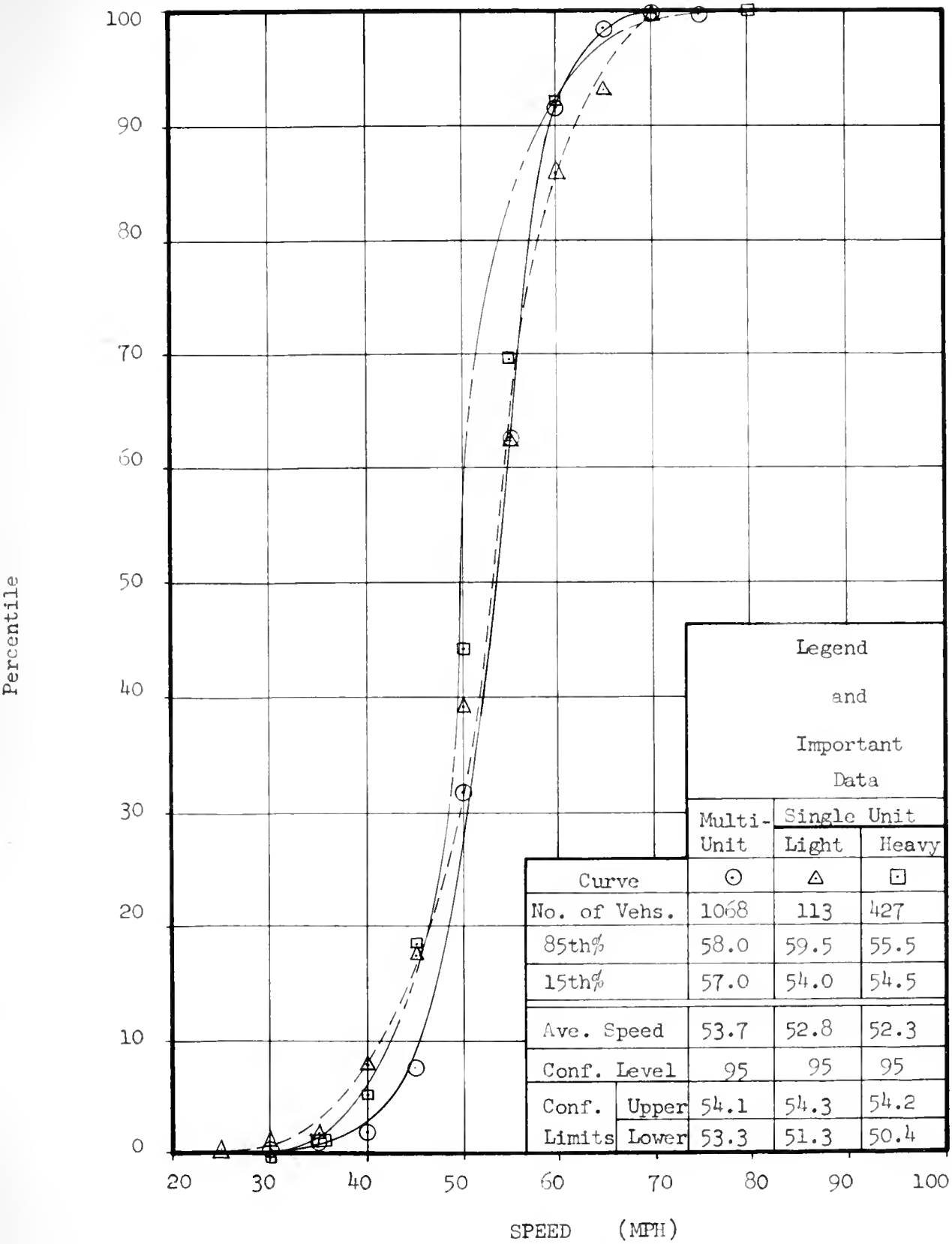

Figure 5, Accumulative Speed Curves,

All Highways

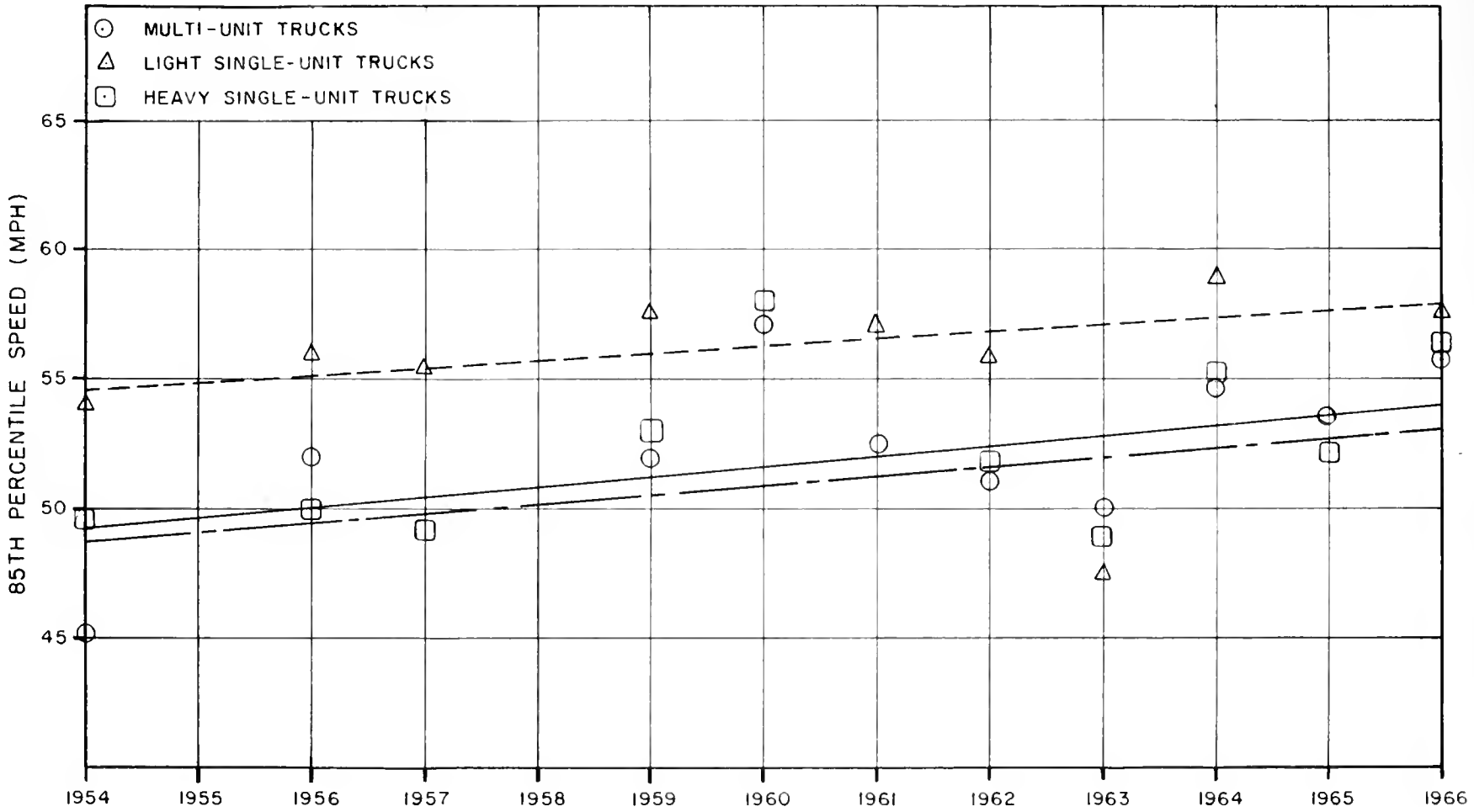

FIG. 6 - TRENDS IN THE 85TH PERCENTILE TRUCK SPEED ON TWO-LANE HIGHWAYS (1954-1966)

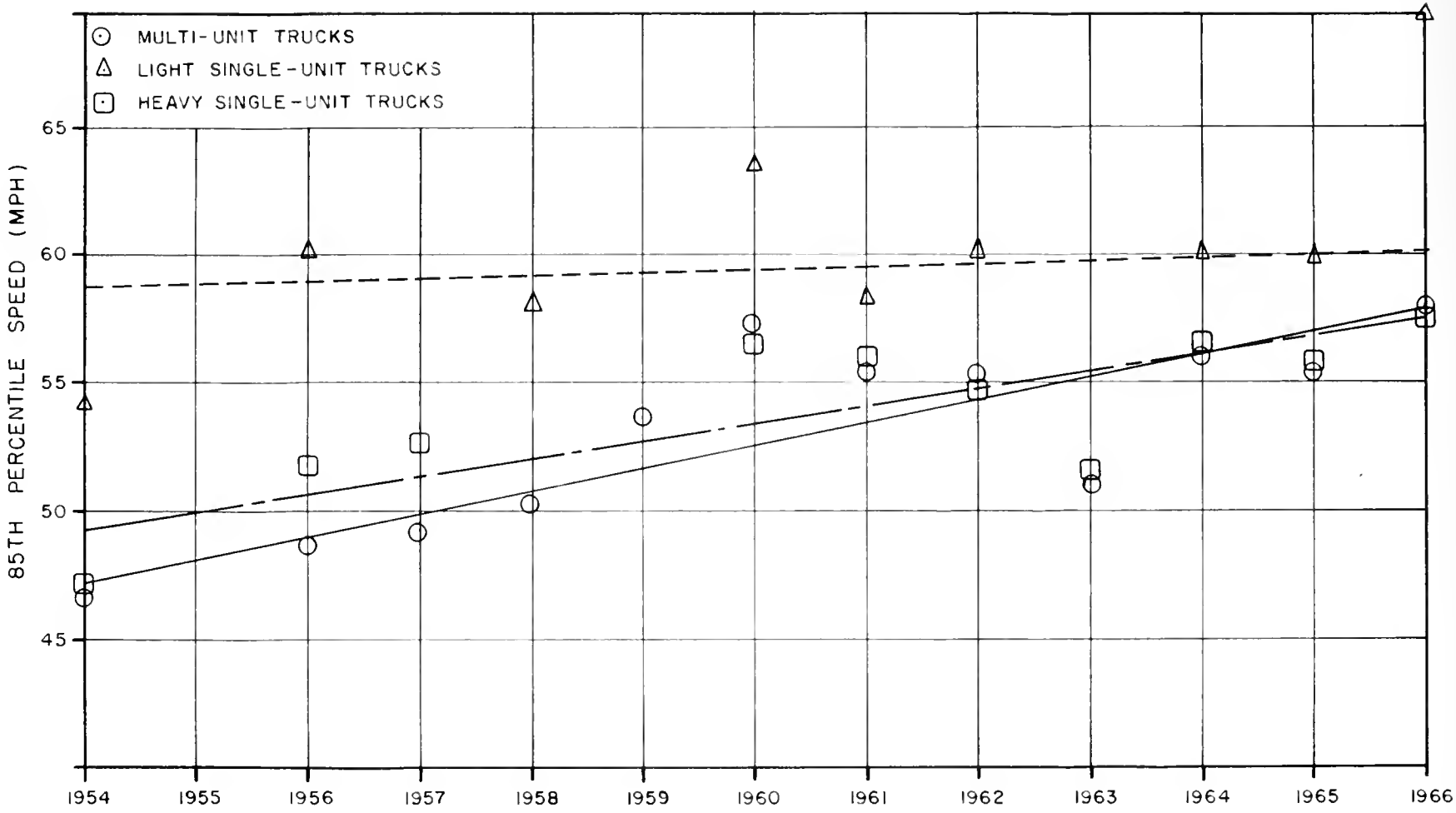

FIG. 7 - TRENDS IN THE 85TH PERCENTILE TRUCK SPEED ON FOUR-LANE HIGHWAYS (1954-1966)

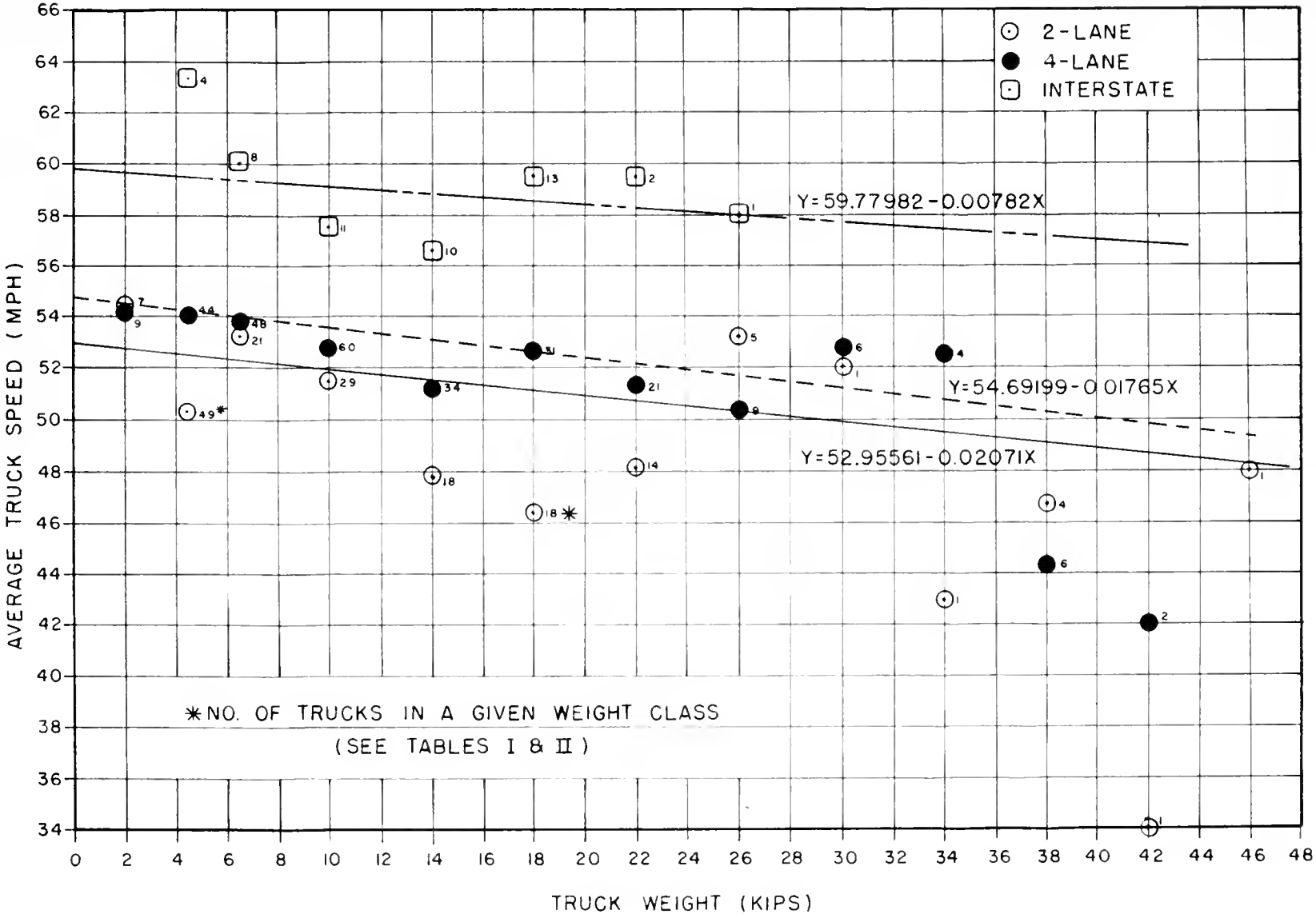

FIG. 8 - REGRESSION ANALYSIS: SINGLE UNIT TRUCKS BY ROADWAY TYPE

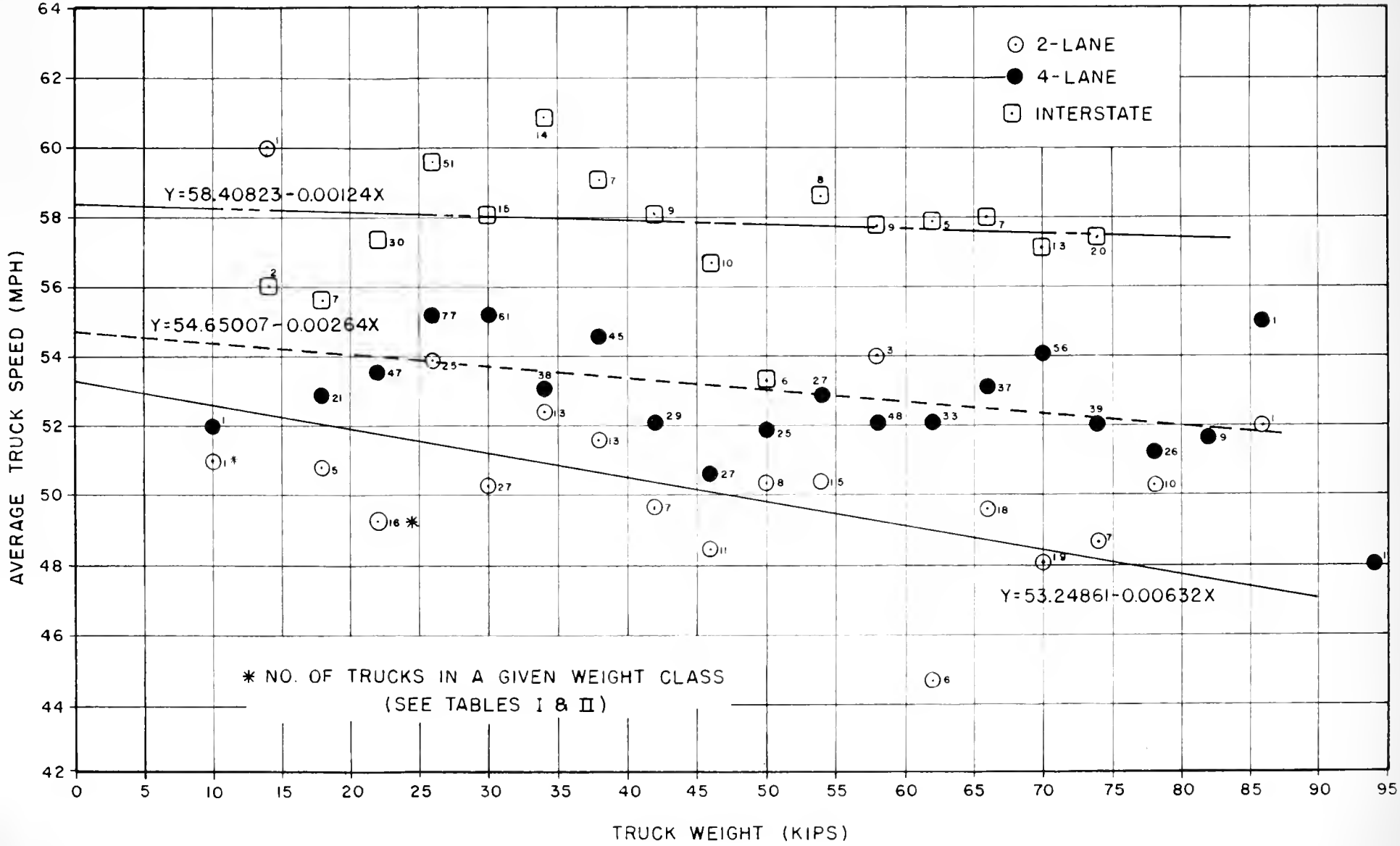

FIG.9-REGRESSION ANALYSIS: MULTI-UNIT TRUCKS BY ROADWAY TYPE

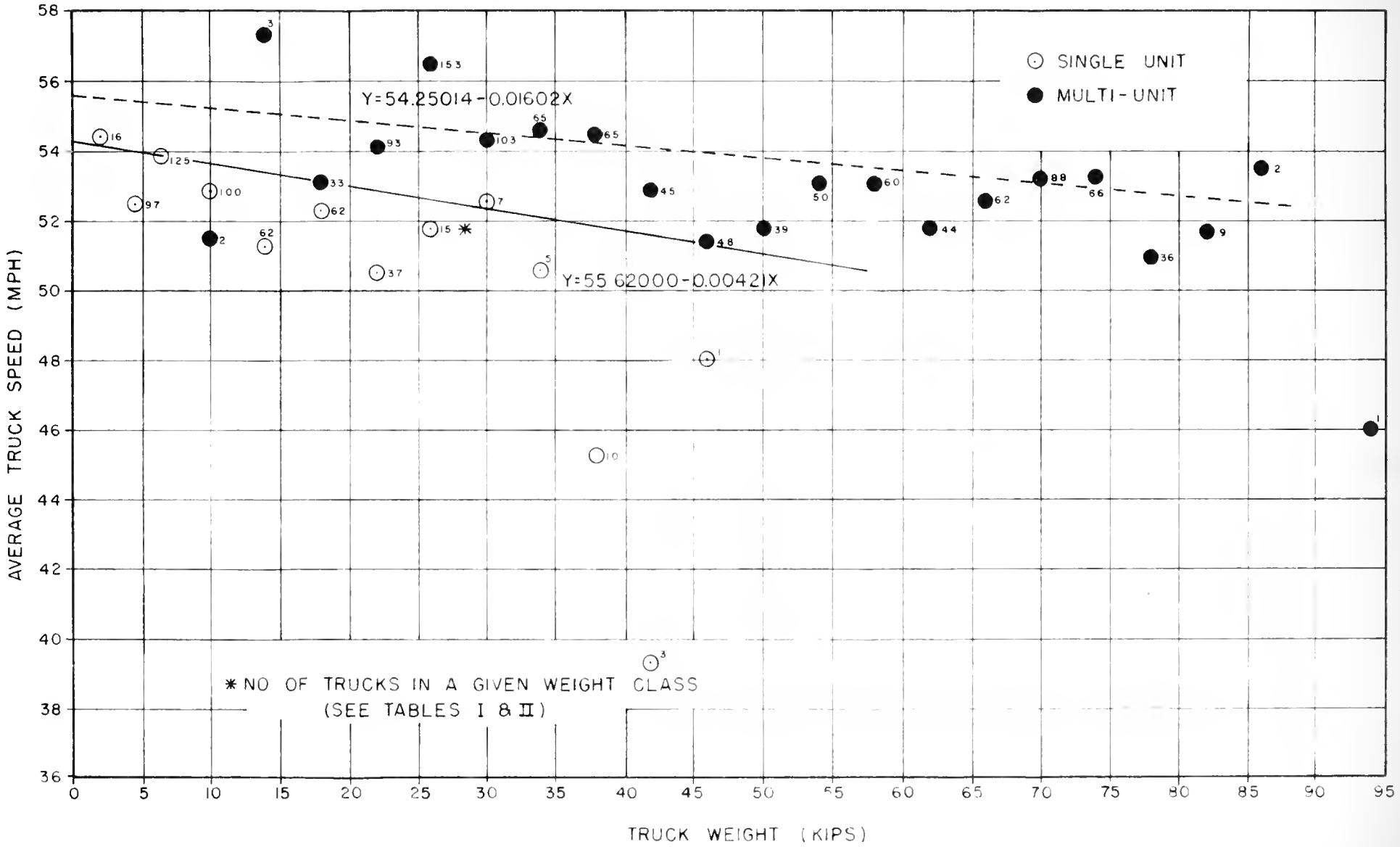

FIG. 10 - REGRESSION ANALYSIS: ALL TRUCKS BY TRUCK TYPE

Summary and Conclusions

The linear equations found by the multiple regression technique, giving the relationship between truck weight and speed, Figures 8, 9, 10, indicate that as truck weight increases the speed decreases. However each "r^2" term which expresses the fraction of the variability explained by this relationship is very small. For example the equation for multi-unit trucks has an r^2 of .019524 indicating that about 2 percent of the variation in speed is correlated to an increase in weight.

The "r^2 term" for each classification of truck and roadway is as follows:

Equation	r	r^2
Single Unit - 2 Lane	.236782	.056066
Single Unit - 4 Lane	.224647	.050466
Single Unit Interstate	.091465	.008366
Multi-Unit - 2 Lane	.204208	.041701
Multi-Unit - 4 Lane	.096492	.009311
Multi-Unit Interstate	.049526	.002453
Single Unit (total)	.187314	.035087
Multi-Unit (total)	.139727	.019524

A value of 1.0 for r^2 would indicate that the increase in weight of a truck would always cause the same change in speed i. e. all of the variation in speed could be explained by the weight. A small value of r^2 such as those found in this study indicates a very small correlation between the two. Other factors must be the parameters which determine truck speed.

The trend in 85th percentile truck speeds on 4-lane highways is still increasing; moreover, the data for 1966, when compared with that of the previous 2 years seems to indicate a linear increase in speed. The data from 196 indicated a possibility of a leveling trend but the 1966 data seems to indicate that this may not be the case. The 85th percentile speeds on 2-lane highways also show an increasing trend.

Table 5 indicates that 7.6% of the light single unit trucks, 44.7% of the heavy single unit trucks, and 43.1% of the multi-unit trucks were exceeding the speed limit on rural highways. The percentages were 9.4% of light single units, 58.9% of heavy single units, and 74.7% of multi-units. These percentages indicate that trucks tend to travel at about the same speed on both types of facilities even though the speed limits are different. The exception to this is the multi-unit class which shows a higher speed on 4-lane facilities. The percentages of trucks speeding on the interstate sections were: light single unit 7.6%, heavy single unit 68.9%, multi-unit 69.1%. Over one half of the heavy trucks were travelling between 55 and 60 mph.

The overall average speed is still increasing, as has been the trend for many years. Single unit trucks had an average speed of 52.4 mph, up from 52.0 in 1965. The average weight of single unit trucks, however decreased slightly from 12,900 to 11,700. Multi-unit trucks had an average speed of 53.7mph, up from 53.1 in 1965. The average weight of multi-unit trucks decreased also, from 46,500 to 44,300. The decrease in average weight, however, is not thought to have been caused by the sampling procedure.

Recommendations For Further Studies

1. Station 61 has very low multi-unit volumes. Because of this the significance of the data at this station is doubtful. A higher volume 2-lane facility would provide better results.
2. At some of the weight stations enforcement was carried out by State Policemen on duty. This fact affected the results later in the day. The excellent communications between truck drivers is well known, and the fact that summons were being issued to over weight vehicles had a significant affect on the weights of the trucks that followed. This could be a significant cause for the decrease in average weights which was noted between 1965 and 1966. This enforcement should not be allowed if the sample is to have continuing statistical significance.
3. On high volume facilities when the waiting line got too long, all small trucks were allowed to pass. As volumes increase this practice will have an increasingly significant impact. A random sample must be obtained if the results of the studies are to be considered valid. When volumes get high a set procedure for sampling should be established such as every third or fourth truck rather than pass through all light trucks.